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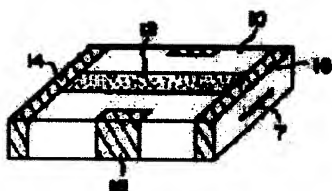
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**(54) NOISE FILTER**



(57)Abstract:  
PURPOSE: To obtain a noise filter which is of surface-mounting type and provided with a built-in resistor.  
CONSTITUTION: Ceramic base material layers and inner conductor layers 7 are alternately laminated into a laminated body 10 which is of integral structure and possessed of a varistor function. A resistor 12 is provided onto the upside of the laminated body 10, and an input electrode 14, an output electrode 16, and a ground electrode 18 are provided onto the surface of the laminated body 10. Noises penetrating a varistor component are absorbed by a part which is formed of an inner conductor and a ceramic base material inside the laminated body 10 and possessed of a varistor function. Furthermore, noises which are not absorbed by a part possessed of a varistor function are conducted to the resistor 12 connected to the electrodes 14 and 16

absorbed.

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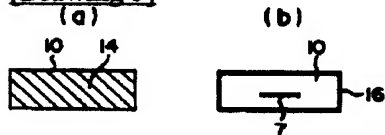
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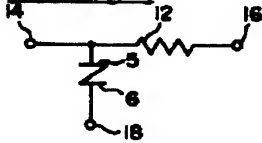
DRAWINGS

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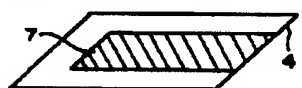
[Drawing 5]



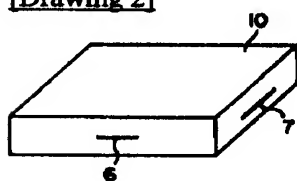
[Drawing 6]



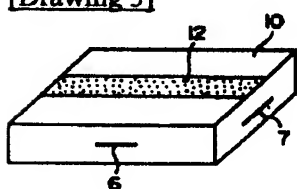
[Drawing 1]



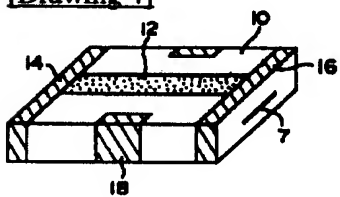
[Drawing 2]



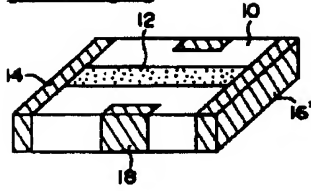
[Drawing 3]



[Drawing 4]



**[Drawing 7]**



#### **DETAILED DESCRIPTION**

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##### **[Detailed Description of the Invention]**

**[0001] [Industrial Application]** This invention relates to the noise filter used for the cure against EMI and the cure against immunity of a signal-transmission line.

**[0002] [Description of the Prior Art]** Conventionally, noise filters, such as a varistor, are adopted for the cure against EMI and the cure against immunity of a signal-transmission line. And it is known by connecting resistance components to this noise filter at a serial that the further excellent noise filter effectiveness will be acquired.

**[0003]** However, since the noise filter and resistance components which are another components were combined conventionally, there was a problem that sizes, such as a printed wired board in which these components are carried, became large. Moreover, after being able to print an electrode and a resistor on front faces, such as a varistor substrate, and being burned on them, the resistance built-in noise filter furnished with a lead terminal is also in said electrode. However, there was a problem that the need from a user was not components high surface mount type.

**[0004]** Then, the technical problem of this invention is to offer the small noise filter which the surface mount was made and contained resistance.

**[0005] [Means for Solving the Problem and its Function]** In order to solve the above technical problem, the noise filter concerning this invention (a) The

laminating of a ceramic base material layer and the inner conductor layer is carried out by turns. A varistor or the layered product of a capacitor which has one of functions at least, (b) The I/O electrode prepared in the both ends of said layered product, respectively, and the front face of the (c) aforementioned layered product or the internal resistor which was prepared in either at least and connected to said I/O electrode, (d) It is characterized by having the grand electrode prepared in the front face of said layered product.

[0006] The surface mount of the noise filter is carried out to a printed wired board etc. by the above configuration using the I/O electrode and grand electrode which were prepared on the surface of the layered product. In the interior of a layered product, the part of a varistor or a capacitor which has one of functions at least is formed in an inner conductor and a ceramic substrate. The noise which invaded into the noise filter is absorbed in the part of said varistor or a capacitor which has one of functions at least, and a part for the noise which was not absorbed in this part is further absorbed in propagation and this resistor by the resistor connected to the I/O electrode.

[0007] Moreover, it becomes unnecessary to carry out distinction of the input side of a layered product, and an output side until it will prepare an I/O electrode and grand electrode on the surface of a layered product in manufacture of a noise filter, if it is made to connect with one side of the inner conductor which exposed only one [ among the I/O electrodes which was made to expose an inner conductor to the end face of the both ends of a layered product, respectively, and was prepared in the both ends of said layered product, respectively ] I/O electrode to the end face of said layered product, and mass production nature becomes good.

[0008] [Example] Hereafter, one example of the noise filter concerning this invention is explained with reference to an accompanying drawing. As a noise filter, varistor components are made into an example and this example explains

them. Drawing 1 is the decomposition perspective view of varistor components. The ceramic base material sheets 2, 3, and 4 knead the organic binder containing the powder which used the varistor ingredient (for example, ZnO, SrTiO<sub>3</sub> grade) as the principal component, and make this the shape of a sheet. If high dielectric constant ingredients, such as a ZnO system, are adopted as a varistor ingredient -- the dielectric constant property -- a bypass capacitor -- work. At an actual mass production process, the ceramic base material sheets 2-4 are cut into a predetermined dimension after a laminating using an extensive area thing. Internal electrodes 5, 6, and 7 are formed in the top face of the ceramic base material sheets 2-4 by means, such as printing. The conductive paste of Ag-Pd etc. is used for the ingredient of internal electrodes 5-7.

[0009] In this way, the prepared ceramic base material sheets 2-4 carry out sticking-by-pressure shaping, and let them at one be layered products 10 (to refer to drawing 2), after being put and accumulating the protection sheet 9 on an upside and the bottom further. After a layered product 10 is cut into a predetermined dimension, it is calcinated at the temperature of about 1100 degrees C. In this condition, the layered product 10 has possibility of demonstrating varistor ability in the part between internal electrodes 5 and 6, and the part between internal electrodes 6 and 7, respectively.

[0010] Next, as shown in drawing 3, a resistor 12 is formed in the top face of a layered product 10 with means, such as spreading or plating. A carbon resistance, cermet resistance, etc. are used for the ingredient of a resistor 12. Next, as shown in drawing 4 and drawing 5 (a), and (b), an input electrode 14, an output electrode 16, and the grand electrode 18 are formed in the both ends and center section of the layered product 10, respectively. Of course, formation of these electrodes may be performed before formation of a resistor 12. The input electrode 14 is electrically connected to one edge of an inner conductor 5 and a resistor 12. The output electrode 16 is electrically connected to the other-end section of a resistor 12. Furthermore, the grand electrode 18 is electrically connected to an inner conductor 6. Therefore, the inner conductor 7 is electrically

connected to neither of electrodes 14, 16, and 18.

[0011] Drawing 6 is the electric representative circuit schematic of the varistor components which contained the resistance obtained in this way. The noise which varistor ability was demonstrated in the part between inner conductors 5 and 6, and has invaded from the input electrode 14 is absorbed in this part. On the other hand, in the part between inner conductors 6 and 7, varistor ability is not demonstrated and noise absorption is not performed. That is, the input side and output side of varistor components are determined by forming electrodes 14, 16, and 18 in a layered product 10. Therefore, in a production process, to the process which forms electrodes 14, 16, and 18 in the front face of a layered product 10, a layered product 10 can be dealt with without carrying out distinction of an input side and an output side, and the handling by the formation process of a resistor 12 and the formation process of electrodes 14, 16, and 18 becomes simple. Moreover, since the configurations of an input electrode 14 and an output electrode 16 differ, in case this varistor component is mounted in a printed wired board etc., there is also an advantage that an activity mistake which carries out an input side and an output side reversely, and is attached in a printed wired board etc. can be prevented beforehand.

[0012] A part for the noise which was not absorbed in the part between inner conductors 5 and 6 is absorbed by the resistor 12 by propagation and this resistor 12. In this way, the resistance built-in varistor components excellent in the noise absorption effect are obtained. In addition, the noise filter concerning this invention is not limited to said example, within the limits of the summary, can be boiled variously and can deform.

[0013] Although varistor components were made into the example and said example explained them as a noise filter, it may not be limited to this and you may be capacitor components. In this case, a capacitor material (for example, BaTiO<sub>3</sub>) is used as an ingredient of a ceramic base material sheet. Moreover,

you may make it both the I/O electrode 14 and 16' which were prepared in the both ends of a layered product, respectively cover the end face of a layered product, as shown in drawing 7 . In this case, I/O electrode 16' will be formed in the condition of having connected with the inner conductor 7 electrically.

[0014] Furthermore, it is not necessary to necessarily prepare a resistor on the surface of a layered product, and it may be prepared in the interior of a layered product.

[0015] [Effect of the Invention] Since it is having the structure which equipped with the resistor the front face or the interior of a layered product which according to this invention carried out the laminating of a ceramic base material layer and the inner conductor layer by turns, and constituted it from the above explanation so that clearly, said noise is absorbed for a part for the noise which was not absorbed in the part which has one [ at least ] function of the varistor formed in the interior of a layered product with the inner conductor and the ceramic base material, or a capacitor by the resistor in propagation and this resistor. Therefore, the resistance built-in small noise filter excellent in the noise absorption effect is obtained.

[0016] Moreover, what can carry out a surface mount to a printed wired board etc. using the I/O electrode and grand electrode which were prepared on the surface of the layered product is obtained. Furthermore, it becomes unnecessary to carry out distinction of the input side of a layered product, and an output side until it will prepare an I/O electrode and grand electrode on the surface of a layered product in manufacture of a noise filter, if it is made to connect with one side of the inner conductor which exposed only one [ among the I/O electrodes which was made to expose an inner conductor to the end face of the both ends of a layered product, respectively, and was prepared in the both ends of said layered product, respectively ] I/O electrode to the end face of said layered product, and mass production nature becomes good.